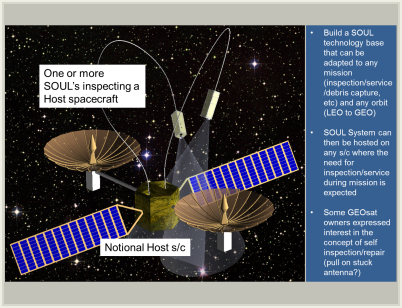
SOUL System Maturation, Phase I

Completed Technology Project (2015 - 2015)

Project Introduction

Busek Co. Inc. proposes to advance the maturity of an innovative Spacecraft on Umbilical Line (SOUL) System suitable for a wide variety of applications of interest to NASA, DoD and commercial missions. SOUL is a small (<10kg) robotic, self-propelled, self-navigating, autonomous vehicle equipped with a tool (e.g. gripper, light, camera etc.). The SOUL vehicle/robot is attached via the umbilical line to a larger host spacecraft that stows it in a marsupial-like manner and communicates with ground. The umbilical delivers power and commands to SOUL from the host spacecraft. Conceptually, the SOUL is a tool on the end of tens of meters long robotic arm with infinite degrees of freedom (flexible umbilical) that can access locations unreachable by conventional robotic arms. The initial purpose of the USAF and Navy funded SOUL development was removal of large space debris (1000kg class). SOUL has broad applicability including visual inspection and servicing of the host vehicle or other spacecraft and asteroid sample pickup. Under this program, the development of the SOUL vehicle was extremely successful exceeding all goals. The SOUL autonomously recognized simulated debris, estimated its pose relative to the target (fusing visible, IR images and IMU information), planned a path to the debris and executed the path and the touched the target with minimal momentum transfer. The demonstrations were performed on large, low friction air table. In the proposed effort Busek will focus on the development of the deployment/retrieval subsystem which is the least mature technology of the SOUL system. Demonstration of the integrated system will be performed on the air table. The ultimate goal is to make a flight worthy system and demonstrate it on the ISS. The specific objective of the Phase 1 is to design, build and test the umbilical line winch and its control system designed on the basis of numerical model that predicts the umbilical line dynamic behavior.



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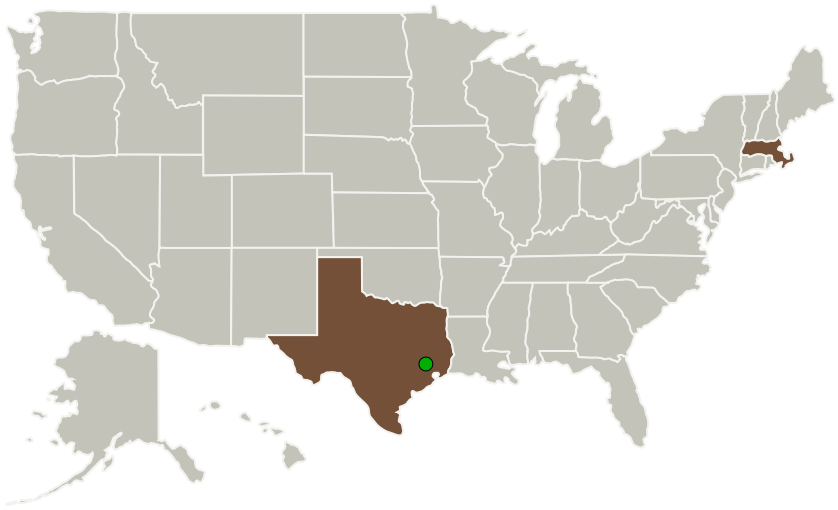
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Busek Company, Inc.	Lead Organization	Industry Women-Owned Small Business (WOSB)	Natick, Massachusetts
Johnson Space Center(JSC)	Supporting Organization	NASA Center	Houston, Texas

Primary U.S. Work Locations	
Massachusetts	Texas

Project Transitions

June 2015: Project Start

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Busek Company, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Vlad Hruby

Co-Investigator:

Vlad Hruby

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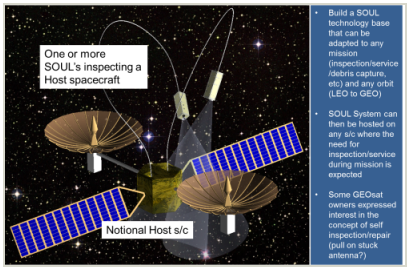
December 2015: Closed out

Closeout Summary: SOUL System Maturation, Phase I Project Image

Closeout Documentation:

- Final Summary Chart Image*(https://techport.nasa.gov/file/139356)*

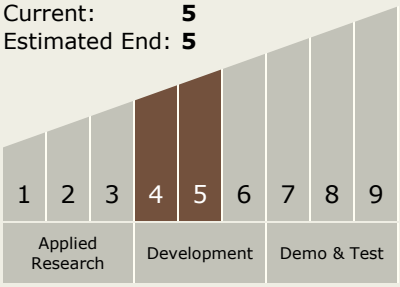
Images



Briefing Chart Image
SOUL System Maturation, Phase I *(https://techport.nasa.gov/image/126560)*

Technology Maturity (TRL)

Start: **4**
Current: **5**
Estimated End: **5**



Technology Areas

Primary:

- TX04 Robotic Systems
  - TX04.1 Sensing and Perception
    - TX04.1.1 Sensing for Robotic systems

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System